

REMARKS/ARGUMENTS

The amendments and remarks hereto attend to all outstanding issues in the pending office action of 5 November 2004. Claims 1-3 and 7-11 are pending in this application. Claims 1, 3, 7 and 9-11 are amended. Claims 4, 5 and 6 are canceled.

In the Specification

Applicants amend the specification herewith to correct errors that are of a typographical and/or grammatical nature.

The substitution of the character Ψ for y at specification paragraph [00107] is supported by the text at the top of FIG. 35 (“PSI=10”).

None of the specification amendments adds new matter to the application.

In the Claims

Claims 1, 3, 7 and 9-11 are amended herewith. Each of the claim amendments is supported by the specification as filed. See also the attached Rule 132 Declaration filed herewith. None of the claim amendments adds new matter to the application.

Claims 4, 5 and 6 are canceled herewith.

Responses to Examiner’s Statements, Objections and Rejections

The following responses follow the order of the sections laid out in the Office Action of 5 November, 2004.

1. Drawings

Applicants note Examiner’s objection to the drawings under 37 CFR 1.83(a) and the requirement that “the features concerning ‘no zeros in subsequent detected spatial frequencies’ recited in claims 1, 7, 9 and 11 must be shown or the feature(s) canceled from the claim(s).” We point out, first, that claim 9 does not have a *feature* concerning “no zeroes in subsequent detected spatial frequencies” but rather “an optical transfer function [“OTF”] that has no zeros within spatial frequencies of a detector.” That is, the “no zeros” requirement does not apply to spatial frequencies themselves, but applies to an optical transfer function at certain spatial frequencies. We also point out that claims 1, 7 and 11 are amended to contain similar language:

claim 1 now recites “no zeros in an optical transfer function over detected spatial frequencies of the optical image” with minor wording changes in claims 7 and 11. Finally, it should be clear with reference to paragraphs 6, 8 and 9 of the attached Rule 132 declaration that the figures do indeed support the “no zeros” language of the claims. As such it should be clear that an OTF is a way to describe certain attributes of an optical system, and that spatial frequencies are an inherent aspect of an image. Limitations on an optical transfer function or to spatial frequencies in a claim does not make either of them a “feature” that must be shown in a drawing. See paragraphs 6 and 8 of the attached Rule 132 Declaration. Applicants therefore traverse the Examiner’s requirement and request the reconsideration and withdrawal of the objection to the drawings under 37 CFR 1.83(a).

2. Information Disclosure Statement

The Examiner has indicated that the references submitted in the Information Disclosure Statements filed January 16, 2004 have not been considered because it “does not include a concise explanation of the relevance.” Office Action, page 2. Applicants contend that a requirement to include a concise explanation of the relevance of each cited reference is only a requirement when the reference is not in the English language, as per 37 CFR §1.98(3)(i).

The Examiner is respectfully reminded that it is Applicants’ duty to submit all known material references, and that submission of material with unknown materiality is also encouraged. For example, MPEP 2004, Item 10 states:

“When in doubt, it is desirable and safest to submit information, even though the attorney, agent, or applicant doesn’t consider it necessarily material, someone else may see it differently.”

Applicants have fulfilled the duty of disclosure by submitting all material references and those of unknown materiality, meeting at least the minimum requirements provisions of 37 CFR §§1.97 and 1.98. MPEP 609 states plainly:

“Once the minimum requirements of 37 CFR 1.97 and 37 CFR 1.98 are met, the examiner has an obligation to consider the information.”

Applicants therefore traverse the Examiner’s statement that “It is therefore applicant’s responsibility to present to the examiner what is the relevance in each of the references” as unsupported by applicable law, or by patent office rules or policy as

reflected in Title 37, Code of Federal Regulations and the MPEP. Applicants respectfully request consideration of the references contained in the submitted Information Disclosure Statements.

3. – 4. Claim Rejections – 35 U.S.C. §112

Claims 1-11 stand rejected under 35 U.S.C. §112, first paragraph, as based on a disclosure which is not enabling. The Examiner's points are addressed below in the order that they are listed in the Office Action, and we indicate the claims believed to be affected by each point. However, Applicants have not been able to connect the Examiner's points to all of the claims rejected, and request the Examiner's help in locating any specific claims that the Examiner believes do not comply with the enablement requirement after the amendments and arguments presented herewith are considered.

i. The Examiner states: “ ‘*Optical element for generating image*’ and ‘*method step for converting the optical image into “detected spatial frequencies of optical image”*’ with regard to claim 1, ... are critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure.” Office Action, page 3. We contend that techniques for performing all of the steps of claim 1, as amended, are known and/or enabled by Applicants' disclosure. See paragraph 8 of the Rule 132 Declaration. Applicants therefore request reconsideration of the rejection of claim 1 under the enablement requirement of 35 U.S.C. §112, first paragraph.

ii. The Examiner also states that “ ‘*image detector for converting optical image to detected electrical images*,’ with regard to claims 7, 9 and 11 are **critical or essential** to the practice of the invention but not included in the claims is not enabled by the disclosure.” Office action, page 3. Applicants note that each of claims 7, 9 and 11 as amended includes a “detector.” Applicants therefore contend that no structural or logical link is missing from claims 7, 9 and 11 as amended and accordingly request reconsideration and withdrawal of the rejection of claims 7, 9 and 11 under the enablement requirement of 35 U.S.C. §112, first paragraph.

iii. The Examiner states, “The specification **fails** to teach that by simply having *an optical mask* that an image can be generated as claimed in claims 1-6.”

Applicants point out, first, that claim 1 does not recite an “optical mask,” but rather an “optical element” for “forming” an optical image. Therefore no structural or logical link is missing from claim 1. Reconsideration and withdrawal of the rejection of claim 1 under the enablement requirement of 35 U.S.C. §112, first paragraph is requested.

Second, Applicants point out claims 2 and 3 do not claim that “an image can be generated.” Claim 2 places limitations on the step of modifying phase of claim 1, and claim 3 requires a post-processing step. Applicants therefore request reconsideration of the rejection of claims 2 and 3 under the enablement requirement of 35 U.S.C. §112, first paragraph. Claims 4-6 are canceled.

iv. The Examiner states, “The specification also fails to teach that by simply having an optical element an “electronic image’ can be rendered as recited in claims 3 and 4.” Applicants note that claim 1, on which claim 3 depends, has been amended to include a step of “detecting the optical image,” and that the step of “detecting” supplies the element required to form the “electronic image” required in claim 3. Applicants request reconsideration of the rejection of claim 3 under the enablement requirement of 35 U.S.C. §112, first paragraph. Claim 4 is canceled.

v. After thorough search and consideration of paragraph 4 of the current Office Action, Applicants find no statements or arguments directed to lack of enablement of pending claims 8 or 10. Reconsideration and withdrawal of the Examiner’s rejection of these claims under the enablement requirement of 35 U.S.C. §112, first paragraph is respectfully requested; if this rejection is maintained, Applicants request the Examiner’s assistance in identifying the reasons therefor.

5. Claim Rejections – 35 U.S.C. §112

Claims 1-11 stand rejected under 35 U.S.C. §112, first paragraph, as based on failing to comply with the enablement requirement. The Examiner’s points are addressed below in the order that they are listed in the Office Action, and Applicants point out the claims believed to be affected by each point. However, Applicants have not been able to connect the Examiner’s points to all of the claims rejected, and request the Examiner’s help in locating any specific claims that the Examiner believes

do not comply with the enablement requirement after the amendments and arguments presented herewith are considered.

i. The Examiner states: “The specification and the claims fail to teach how could the modulation of the wavefront phase will make ‘no zeros in subsequent spatial frequencies of the optical images’ as recited in claims 1, 7, 9 and 11. The Figures 9-15 of the instant application show **explicitly** that **there are zeros** in spatial frequencies.” Office Action, page 3-4.

Applicants point out, first, that claims 1, 7, 9 and 11 do not recite “modulation of the wavefront phase” either before or after the amendments herein.

Second, Applicants note that Figure 9 shows an ambiguity function, not an optical transfer function, as discussed at specification paragraph [0090]: “Figure 9 shows the ambiguity function...” Specification, paragraph [0090]. Furthermore, the vertical scale of Figure 9 has no label, so no value of zero can be obtained therefrom.

Third, Applicants also point to paragraphs 8 and 9 of the attached Rule 132 Declaration, which shows how these claim amendments are enabled. The same reasoning applies to each of claims 7, 9 and 11. Applicants therefore request reconsideration and withdrawal of the rejection of claims 1, 7, 9 and 11 under the enablement requirement of 35 U.S.C. §112, first paragraph.

ii. The Examiner also states: “The specification and the claims **fail** to teach how could the range of misfocus is beyond $\pm \pi/10$.” Office Action, page 4. Applicants point out, first, that claim 11 has been amended to read “over a range of Ψ from $-\pi/10$ to $\pi/10$.” Second, Applicants note that a range of Ψ from $-\pi/10$ to $\pi/10$ finds support in an example shown in the specification and in FIG. 11 and FIG. 12. FIG. 11 shows “the magnitude of the OTF of the C-PM system of Figure 2 with mild misfocus ($\Psi = 1/2$),” specification as filed, paragraph [0092], and FIG. 12 shows “the magnitude of the OTF ... with large misfocus ($\Psi = 3$),” specification as filed, paragraph [0093]. Since $\pi/10$ is approximately 0.31, these examples show that the range of Ψ from $-\pi/10$ to $\pi/10$ can be met or exceeded in an embodiment.

Applicants therefore request reconsideration and withdrawal of the rejection of claim 11 under the enablement requirement of 35 U.S.C. §112, first paragraph.

iii. After thorough search and consideration of paragraph 5 of the current Office Action, Applicants find no statements or arguments directed to lack of enablement of pending claims 2, 3, 8 or 10. Reconsideration and withdrawal of the Examiner's rejection of these claims under the enablement requirement of 35 U.S.C. §112, first paragraph is respectfully requested; if this rejection is maintained, Applicants request the Examiner's assistance in identifying the reasons therefor.

6. Claim Objections - informalities

Claims 1-11 have been objected to because of informalities. The Examiner's points are addressed below in the order that they are listed in the Office Action, and Applicants point out the claims believed to be affected by each point. However, Applicants have not been able to connect the Examiner's points to all of the claims objected to, and request the Examiner's help in locating any specific claims that the Examiner believes contains informalities after the amendments and arguments presented herewith are considered.

i. The Examiner states, "The phrase 'no zeros in subsequent detected spatial frequencies of the optical image' recited in claims 1, 7, 9 and 11 are confusing and indefinite since zeros are generally referring to a mathematical function, and it is not clear what mathematical function is referred here to have this property of no zeros." Office Action, page 4. Applicants believe that the amendments to claims 1, 7, 9 and 11 remove the informality to which the Examiner has objected. Reconsideration and withdrawal of the Examiner's objection to claims 1, 7, 9 and 11 is requested.

ii. The Examiner also states, "It is also not clear what does it mean by 'spatial frequencies of the optical image', please explain this phrase and to give a **physical** meaning to such." See paragraph 8 of the Rule 132 Declaration. Applicants note that the Examiner has not connected this statement with a claim objected to, and therefore request reconsideration and withdrawal of any objection deemed relevant to this statement; if the objection is maintained, Applicants request that the Examiner please assist by stating the claim that is objected to by claim number.

iii. The Examiner states, "Claim 3 is complete confusing since it is not clear how can the effects of the mask are removed in the post processing step, (which means no mask function exist), yet the extended focus still can exist and a clear image

is formed.” Office Action, page 4. Applicants believe that the amendment to claim 3, eliminating the requirement that the post processing “remove effects induced by the optical mask,” eliminates the informality to which the Examiner has objected. Reconsideration and withdrawal of the Examiner’s objection to claim 3 is requested.

iv. After thorough search and consideration of paragraph 6 of the present Office Action, Applicants find no statements or arguments directed to informalities in any of pending claims 2, 8 and 10. Reconsideration and withdrawal of the Examiner’s objection to claims 2, 8 and 10 is respectfully requested; if this objection is maintained; Applicants request assistance from the Examiner in identifying specific claims and reasons for objection.

7. – 8. Claim Rejections – 35 U.S.C. §103

Claims 1-11 stand rejected by the Examiner under 35 U.S.C. §103 as unpatentable over the article “Optical/digital incoherent image processing for extended depth of field” by Poon et al. (“Poon”). Applicants respectfully disagree and traverse this rejection.

The following is a quotation from the MPEP setting forth the three basic criteria that must be met to establish a *prima facie* case of obviousness.

“To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.” MPEP §2142, citing *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Claim 1

Applicants’ claim 1, as amended, recites a method for generating an optical image comprising the following steps:

- i) forming an optical image with at least one optical element of an optical imaging system while modifying wavefront phase, wherein modifying phase does not reduce an optical bandpass limited by an aperture of the optical imaging system, and
- ii) detecting the optical image over a range of spatial frequencies such that there are no zeros in an optical transfer function of the optical

imaging system over detected spatial frequencies within the optical bandpass over an extended depth of focus that is larger than a depth of focus occurring without modifying wavefront phase.

Under *In re Vaeck*, there must be (a) some teaching or suggestion to modify the prior art, either in the reference or based on one of ordinary skill at the time the invention was made, without rendering the prior art unsatisfactory, (b) a reasonable expectation of success, and (c) all the claim elements must be taught. 947 F.2d 488, 20 USPQ2d 1438; *see also* *MPEP 2142 and 2143*.

With respect to factor (c) cited in *In re Vaeck*, Poon does not teach “modifying wavefront phase” or “such that there are no zeros in an optical transfer function of the optical imaging system over detected spatial frequencies within the optical bandpass over an extended depth of focus.” The annular aperture of Poon is an obscured optical system that varies amplitude – but not phase – of a wavefront. Poon’s method is similar to the traditional technique of stopping down an aperture (i.e., reducing the diameter through which light can travel) to extend depth of field. Poon also does not teach modifying phase “such that there are no zeros in an optical transfer function of the optical imaging system over detected spatial frequencies within the optical bandpass over an extended depth of focus.” As noted above, Poon teaches an annular aperture to extend depth of field. Since all of the limitations of claim 1 are not found in the cited art, *prima facie* obviousness does not exist; Applicants therefore request reconsideration and withdrawal of the Examiner’s rejection of claim 1 under 35 U.S.C. §103.

Claims 2 and 3

Applicants’ claim 2 depends from claim 1 and benefits from like arguments. Furthermore, claim 2 requires that the step of modifying phase comprise utilizing an optical mask. Poon does not teach modifying phase utilizing an optical mask, therefore the elements of claim 2 are not taught, and Applicants request reconsideration and withdrawal of the rejection of claim 2 under 35 U.S.C. §103. Applicants’ claim 3 depends from claim 2 and benefits from like arguments.

Claims 4-6 are canceled.

Claims 7 and 8

Applicants' claim 7, as amended, recites a system for forming an image, comprising:

- i) at least one lens and an optical mask that cooperate to form an optical image that is limited in frequency content by an aperture of the lens or of the optical mask, and
- ii) a detector for detecting the optical image over a range of spatial frequencies, the optical mask modifying wavefront phase such that there are no zeros in an optical transfer function of the system over detected spatial frequencies of the optical image over an extended depth of focus larger than a depth of focus formed without the optical mask.

As noted with respect to claim 1, Poon does not teach "modifying wavefront phase" or "such that there are no zeros in an optical transfer function of the system over detected spatial frequencies of the optical image over an extended depth of focus." Since all of the limitations of claim 7 are not found in the cited art, prima facie obviousness does not exist. Claim 8 depends from claim 7 and benefits from like arguments; therefore Applicants request reconsideration and withdrawal of the Examiner's rejection of claims 7 and 8 under 35 U.S.C. §103.

Claim 9

Applicants' claim 9, as amended, recites a system for forming an image, comprising a lens and a phase mask that cooperate to form an optical image characterized by an optical transfer function that has no zeros within detected spatial frequencies of a detector that detects the optical image over a larger depth of focus than without the phase mask, wherein the phase mask does not reduce an optical bandpass limited by an aperture of the lens or of the phase mask.

As noted above with respect to claims 1 and 7, Poon does not teach a mask for modifying phase, that is, a "phase mask," or "an optical transfer function that has no zeros within detected spatial frequencies of a detector that detects the optical image." Since all of the limitations of claim 9 are not found in the cited art, prima facie obviousness does not exist. Applicants request reconsideration and withdrawal of the Examiner's rejection of claim 9 under 35 U.S.C. §103.

Claim 10

Applicants' claim 10 depends from claim 9 and benefits from like arguments. Furthermore, claim 10, as amended, requires a "means for post-processing a detected optical image to reverse a phase modification induced in the optical image by the phase mask." As noted with respect to claims 1, 7 and 9 above, Poon does not teach modifying phase, and likewise does not teach removing or reversing effects of modifying phase. Since all of the limitations of claim 10 are not found in the cited art, prima facie obviousness does not exist, and Applicants request reconsideration and withdrawal of the rejection of claim 10 under 35 U.S.C. §103.

Claim 11

Applicants' claim 1, as amended, recites a system having insensitivity to focus, comprising at least one lens, an optical mask and a detector that cooperate to form a detected optical image, the optical mask modifying wavefront phase such that there are no zeros in an optical transfer function of the system within detected spatial frequencies of the detected optical image over a range of Ψ from $-\pi/10$ to $\pi/10$. As noted above with respect to claims 1, 7 and 9, Poon does not teach an "optical mask modifying wavefront phase" at all, let alone "such that there are no zeros in an optical transfer function of the system." Poon also does not teach "no zeros in an optical transfer function of the system ... over a range of Ψ from $-\pi/10$ to $\pi/10$." Since all of the limitations of claim 11 are not found in the cited art, prima facie obviousness does not exist, and Applicants request reconsideration and withdrawal of the Examiner's rejection of claim 11 under 35 U.S.C. §103.

9. – 10. Double Patenting

Applicants note the Examiner's provisional rejection of claims 1-11 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 75, 87, 88, 94, 95 and 99 of copending Application No. 09/070,969.

Conclusion

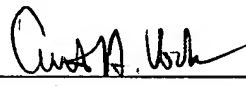
In view of the above Amendments and Remarks, Applicants have addressed all issues raised in the Office Action dated 5 November 2004, and respectfully solicits a Notice of Allowance. Should any issues remain, the Examiner is encouraged to telephone the undersigned attorney.

The Commissioner is authorized to charge a fee of \$1,020.00 to deposit Account No. 12-0600 for a three month extension of time. Applicants believe no other fees are currently due, however, if any other fee is deemed necessary in connection with this Amendment and Response, please charge Deposit Account No. 12-0600.

Respectfully submitted,

LATHROP & GAGE L.C.

Date: 5/5/05

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